

REMARKS

Claims 15-26 remain pending. Favorable reconsideration is respectfully requested.

The present invention relates to a catalyst for trimerizing ethylene. The catalyst comprises, *inter alia*, an organic transition metal complex represented by the formula (1) and an alkylaluminumoxane. In the trimerization, an important product is 1-hexene. There are at least two important parameters in such a process. The first is the overall catalytic activity of the catalyst. The second is the selectivity for the production of 1-hexene instead of other less desirable products, e.g., polyethylene. See the discussion at pages 1-2 of the present specification.

The present inventors have discovered that the combination of the organic transition metal complex represented by the formula (1) and the alkylaluminumoxane in the catalyst of the present invention provides a high level of catalytic activity and high selectivity for 1-hexene production.

The rejection of the claims under 35 U.S.C. §103(a) over Mimura in view of Wu I is respectfully traversed. Those references fail to suggest the claimed catalysts.

Mimura discloses a catalyst for trimerization of ethylene. See the Abstract. The catalyst is composed of (a) a chromium complex and (b) a metal alkyl compound. The catalyst may also include (c) an aromatic tertiary amine compound and (d) a radical anion compound. See the Abstract.

As recognized by the Examiner, Mimura fails to disclose an alkylaluminumoxane.

Wu I discloses a catalyst for ethylene trimerization comprising an alkylaluminumoxane and a polydentate phosphine, arsine and/or stilbene coordination complex of a chromium salt. See the Abstract.

One with the cited references in hand would not have been motivated to incorporate the alkylaluminoxane in the catalyst described by Wu I into the catalyst disclosed by Mimura. The catalyst of Mimura already contains several additional co-components, i.e., the metal alkyl compound, an aromatic tertiary amine compound and the radical anion compound. There is no suggestion in either of the references that an alkylaluminoxane would have a beneficial effect in the catalyst described by Mimura. Without such a suggestion, there is no motivation to add an alkylaluminoxane to the catalyst disclosed by Mimura. Since there is no motivation for such a catalyst, the combined disclosure of Mimura and Wu I fail to suggest the claimed catalysts. Accordingly, the Office has failed to establish a *prima facie* case of obviousness.

In addition, the data presented in the specification of the present application demonstrate the striking non-obviousness of the present invention.

The best catalytic activity was obtained in Example 6 of the Examples of the present application, in Example 6 of the examples in Wu I, and in Example 13 of the examples in Mimura. The following table provides a comparison of the catalytic activity and selectivity of C₆, i.e., the percentage of the desired 1-hexene in C₆ oligomers, obtained with the catalyst of the present invention with Wu I and Mimura.

	Catalytic activity (kg•hexene/g•Cr/h)	1-hexene fraction in C-6 oligomers (wt.%)
Wu I (Example 6) ¹	9	93.7
Mimura (Example 13)	13	96.9
Present Invention (Example 6)	40	99.6

¹Catalytic activity of Wu I was calculated as follows:

Activity 17000 mol•ethylene/mol•Cr/h (Wu I, Table I, Ex. 6)

- (i) If the entire amount of ethylene was converted to hexane, $17000 \times 28.05 \text{ g} (= 476 \text{ kg})$
/mol·Cr/h (M.W. of ethylene = 28.05)
- (ii) Cr = 51.996 g/mol
Thus, $476/51.996 = 9.1 \text{ kg/Cr/h}$
- (iii) Weight fraction of C6 is 94.9 (Wu I, Table I, Ex. 6)
Thus selectivity to C6 is: $9.1 \times 0.949 = 8.7 \text{ kg·hexene/g·Cr/h}$

The data presented above demonstrate that the catalyst of the present invention exhibits the highest level of catalytic activity in the trimerization of ethylene, a level which is far higher as compared to the levels obtained with the catalysts disclosed by Wu I and Mimura. In addition, the catalyst of the present invention exhibits a high selectivity for 1-hexene (C6) in addition to its high catalytic activity.

One reading Mimura and Wu I would not have predicted this striking result. There is no suggestion in those references that the combination of the organic metal complex represented by formula (1) and an alkylaluminumoxane would have higher catalytic activity and higher selectivity for producing 1-hexene. Certainly, no evidence had been cited by the Office for such a suggestion. Therefore, the experimental data presented above demonstrates that the claimed catalysts are not suggested by the combination of Mimura and Wu I.

Withdraw of this ground of rejection is respectfully requested.

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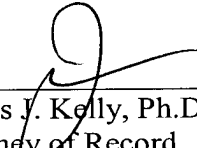
The rejection of the claims under 35 U.S.C. §112, second paragraph, is believed to be obviated by the amendment submitted above. The claims have been amended to make the changes suggested by the Examiner at pages 2-3 of the Official Action dated September 24, 2004. Accordingly, withdraw of this ground of rejection is respectfully requested.

Regarding the restriction requirement, Claim 26 depends directly from Claims 15-20, which are allowable as discussed. Since Claim 26 depends from allowable claims, it should be rejoined with Claims 15-20 under the provisions of MPEP §821.04. Accordingly, withdrawal of the restriction requirement is respectfully requested.

Applicants submit that the present application is in condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

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